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SECMP0046

'Allow DNOs to control Electric Vehicle chargers connected to Smart Meter infrastructure'

Modification Report

Version 0.1

About this document

This document is the Modification Report for SECMP0046 'Allow DNOs to control Electric Vehicle chargers connected to Smart Meter infrastructure'. It provides detailed information on the background, issue, solution, costs, impacts and implementation approach. It also summarises the discussions that have been held and the conclusions reached with respect to this Modification Proposal.

Contents

This document also has two annexes:

- **Annex A** contains the business requirements for the proposed solution.
- **Annex B** contains the full DCC Preliminary Assessment response.

1. Summary

The uptake of Electric Vehicles (EV) and consequently domestic EV chargers is on the rise. This means there will be higher domestic electricity demands, putting strain on the electricity network. Low voltage networks (feeders) supply on average about 36 households but can range from 2-250 and this strain from increased electricity demand has the potential to melt or blow fuses on these feeders. The resulting power outage could take considerable time and money to rectify, leaving multiple homes and potentially vulnerable customers off supply.

There are currently a number of systems in place which should prevent this such as Time of Use (ToU) tariffs and embedded generation or Ancillary Service Providers (ASP). However, there is no last resort option if these market mechanisms fail. SECMP0046 proposes a Smart Metering solution to this issue. It seeks to allow Electricity Distributors to control load to domestic EV chargers using Home Area Network (HAN) Connected Auxiliary Load Control Switches (HCALCS). Electricity Distributors will monitor load on their low voltage networks and, if an overload risk is detected, the Electricity Distributor will send a signal to the HCALCS connected domestic EV chargers on that feeder. This will alter the load, mitigating the risk to the feeder.

This modification will have wide ranging impacts across Supplier Parties, Electricity Network Parties, Other Parties and the Data Communication Company (DCC), requiring changes to systems and processes. The extent of these impacts will be drawn out through consulting with Smart Energy Code (SEC) Parties and relevant stakeholders. If approved, this modification is provisionally targeted for the November 2020 SEC Release.

2. Background

The popularity and ownership of Electric Vehicles (EVs) is on the rise across Great Britain. This also brings an increase of domestic EV chargers installed at domestic premises and connected to local electricity networks. The electrical ratings of these EV chargers are also increasing, allowing for a reduction in charging times but with an associated increase in power requirement.

The increase in EVs in the coming years likely will cluster, increasing the demand on low voltage networks (feeders) that connect multiple properties to substations. Due to predicted charging habits, where it is likely owners would be charging multiple EVs on one feeder at similar times, for example after they return home from work, the demand could possibly exceed the capacity of the fuses and/or the feeder cables, resulting in power outages.

With the growing EV space in Great Britain there is further legislation developing to accommodate this growth. The 'Automated and Electric Vehicles Act 2018'[1] mandates that EV smart charge points shall have the capability to receive, process, and react to information, i.e. be Smart. Additionally, there is a push in the Government's 'Road to Zero Strategy'[2] for new build homes to have EV charge points installed.

Tools available

Currently there are a few options to help prevent such a scenario. These include:

- Time of Use (ToU) tariffs
- Vehicle to Grid (V2G) as ancillary services
- Supplier sets load limit for whole meter through Suppliers control load
- Use of other Ancillary Services

These tools should help reduce high energy demand; however they are optional and are market driven. In cases where these are not sufficient, more robust measures are required.

'Interim solution'

Scottish and Southern Electricity Networks (SSEN) also has an 'interim solution'[3] where they will fit a device to local substations. This device will measure demand on the cable in real-time, assessing whether a managed charging event is needed. If a managed charging event is required, then the substation device will communicate with a device (fitted by the Electricity Distributor) at the customers property. This device at the property will then delay or curtail charging rates. This is considered as an interim solution, requiring an agreement with the customer and activation through their own systems.

What is the issue?

If a power outage does occur due to overloading, large numbers of customers may be affected, and for varying amounts of time. The feeders on average will have about 36 households connected but

[1] Automated and Electric Vehicles Act 2018, July 2018
[2] The Road to Zero, Department for Transport, July 2018
[3] Consultation on the Interim Solution for Domestic Managed Electric Vehicle Charging, EA Technology on behalf of all GB distribution network operators, and led by Scottish and Southern Electricity Networks (SSEN), 2018

can range from 2-250 properties. Depending on what has failed, it may take from an hour to several weeks to restore the network. These cuts to electricity supplies may not only incur financial costs, but also damages in brand image, consumer confidence in the utilities industry, and even risk to vulnerable customers.

Reinforcement of the whole network (transformers, fuses, and/or underground cables) would be the more conventional method; however, this incurs significant cost and large disruptions to energy supply. The Proposer states that previous work has indicated that the potential estimated cost-avoidance savings from having smarter solutions to this problem is £2.2 billion. They reference studies[4] that have shown that managing the charging of EVs at times of network stress can defer or negate this cost.

SECMP0046 was raised by SSEN on 21 February 2019 to resolve this issue.

[4] My Electric Avenue, EA Technology and SSEN, 2015

3. Solution

Proposed Solution

The proposer has suggested that Electricity Distributors should have the ability to act in such an event, curtailing EV charging, if circumstances require. Reaction to such events will need to be fast, ideally 30 seconds, as there is likely only 5-10 minutes between alert and failure This ability to curtail charging of EVs should be treated as a last resort and thought of as another tool the DNOs can use to prevent failure of their networks. The proposed solution in this modification is thought to be a more robust solution than the interim put forward by SSEN.

This would be achieved by the use of Home Area Network (HAN) Connected Auxiliary Load Control Switches (HCALCS). The HCALCS will be connected to domestic EV chargers, and this modification seeks to allow Electricity Distributors the ability to send the relevant Service Request via the Data Communication Company (DCC). This would result in altering the load on an EV charger in the event that the Electricity Distributor detects a potential risk of overloading on a low voltage network.

Suppliers currently have the ability to manage load via HCALCS and this modification would extend these capabilities as well as the capability to install and join HCALCS to the Electricity Distributors. This would be defined in the SEC and require changes to the DCC Systems. Further required governance has been identified in the business requirements in Annex A. This includes:

- Mandating the ALCS/HCALCS label list
- Reporting to Ofgem (where current reporting requirements are already sufficient)
- Customer engagement and consent

Also, the need for governance outside the SEC has been identified, such as the duration that EV charging is curtailed, and usage limits of this solution.

The business requirements to achieve this can be found in Annex A.

Legal text

The changes to the SEC required to deliver the proposed solution will be available toward the end of the Refinement Stage. These will be made available for comment before the Modification Report is presented to the Panel.

4. Impacts

This section summarises the impacts that would arise from the implementation of this modification.

SEC Parties

SEC Party Categories impacted			
✓	Large Suppliers	✓	Small Suppliers
✓	Electricity Network Operators		Gas Network Operators
✓	Other SEC Parties	✓	DCC

Electricity Network Parties will be positively impacted, as they will gain the ability to issue commands to control load associated with EV charging. This has the potential to achieve significant cost benefits and savings by deferring the costs of reinforcement of networks. It also increases their ability to respond to stress in electricity networks in real time to avoid the customer impacts associated with power outages. Their User Systems will also be impacted by having access to send additional Critical Commands.

Large and Small Supplier Parties will be impacted, as the Electricity Distributors will be able to reduce the supply of electricity to the Suppliers customers. The SEC currently only allows Import Suppliers to issue commands that enable or disable the supply of energy. Suppliers may also face some commercial and/or regulatory impacts relating to their energy purchasing, balancing and settling if Electricity Distributors are shifting the load supplied to their customers.

Other SEC Parties will be impacted as the solution will require changes to the Technical Specifications. Device manufactures will need to start adhering to these new specifications.

The DCC will be impacted as the solution requires a change to the DCC Systems.

DCC System

The document changes to Appendix AD 'DCC User Interface Specification' (DUIS) and Schedule 8 Great Britain Companion Specification' (GBCS) will need to be reflected in the DCC Systems. This will be a Data Service Provider (DSP) change to allow the Electricity Distributers to be added as Eligible Users to the relevant Service Requests.

There will be an impact on the Parse and Correlate application provided by Critical Software to reflect the new DUIS definition and GBCS, including updated Service Reference Variant (SRV) definitions and GBCS Use Cases

The full impacts on DCC Systems and DCC's proposed testing approach can be found in the DCC Preliminary Assessment response in Annex B.

SEC and subsidiary documents

The following parts of the SEC will be impacted:

- Schedule 8 'GB Companion Specification'

- Schedule 11 ‘TS Applicability Tables’
- Appendix R ‘Common Test Scenarios Document’
- Appendix AD ‘DCC User Interface Specification’
- Appendix AF ‘Message Mapping Catalogue’

Other industry Codes

Distribution Connection and Use of System Agreement

The period of time that a domestic EV has its charging altered will need to be defined. This is out of the scope of the SEC; however, it has been identified that it may be covered in Distribution Connection and Use of System Agreement (DCUSA) under Schedule 8 ‘Demand Control’. This may need to be amended to define a duration that EV charging is altered for.

Greenhouse gas emissions

There are no impacts on greenhouse gas emissions.

5. Costs

DCC costs

The estimated DCC cost to implement this modification is £560,000.

More information can be found in the DCC Preliminary Assessment response in Annex B.

SECAS costs

The estimated Smart Energy Code Administrator and Secretariat (SECAS) implementation costs to implement this modification is two days of effort, amounting to approximately £1,200. The activities needed to be undertaken for this are:

- Updating the SEC and releasing the new version to the industry.

SEC Party costs

This modification will place costs on SEC Parties, the extent of which we seek to understand as part of the Refinement Consultation.

6. Implementation approach

Recommended implementation approach

The Working Group is recommending an implementation date of:

- **5 November 2020** (November 2020 SEC Release) if a decision to approve is received on or before 5 May 2020.

The Proposer, Working Group members and the DCC agree that the implementation date for this modification would be best suited for implementation in the November 2020 SEC Release. This would coincide with the planned BEIS development of the Proportional Load Control[5] Device.

As stated in the Preliminary Assessment response, the DCC requires a three to six-month lead time between the modification being approved and implementing the proposed solution, meaning that this modification is a candidate for inclusion in the November 2020 SEC Release, should it be approved in sufficient time.

[5]Consultation on Proportional Load Control and associated SMETS drafting, BEIS, August 2019

7. Discussions and development

Working Group solutions

Method of delivery

The Working Group discussed the issue and the two solutions that the Proposer initially the put forward. During these discussions, four additional solutions were raised and discussed.

Smart EV charger

As one of the initial solutions identified by the proposer, this solution would use the DCC Systems to pass signals to a HAN-Connected Smart charger which can vary the rate of charging in response to a parameter passed to it. Due to timelines and difficulty of this solution as well as preventing innovation in the area of EV chargers, this was not progressed.

HCALCS connected EV charger

This second solution presented by the Proposer would deliver the results using the HCALCS to temporarily curtail domestic EV charger's electricity supply. The domestic EV charger would be connected to the HCALCS, and the Electricity distributor would have the appropriate permissions to send the relevance signals when an overload event is detected. This is the solution being investigated.

Supplier Management of Whole-Meter Load

In this solution, when an overloading event is detected by the Electricity Distributor, they would inform the relevant Suppliers. The Suppliers would then send SRV 6.4.1 'UpdateDeviceConfiguration(LoadLimitingGeneralSettings)' to the relevant Electronic Smart Metering Equipment (ESME) to cap the whole load on the ESME. This was dismissed due to the length of time it would take for any reduction in load to be executed since it would have to go through a third party (the Supplier). As previously stated, the time between identification of a feeder failure and the failure itself is very short and this situation requires an immediate (30 second) response time.

Electricity Distributor contract with Ancillary Services Provider

A contract with an Ancillary Services Provider (ASP) would mean that when the Electricity Distributor detected an overloading event, they can contact the ASP to manage the load locally. This would stabilise any fluctuations of load on the low voltage network, mitigating risk of an over loading event. The solution was rejected by the Working Group as there may not be any ASP on the particular feeder at risk as feeders only cover a small number of properties.

Pulse Width Modulation

Pulse Width Modulation (PWM) would allow modification of a domestic EV charger in the event of a detected overloading event. For this to be connected to the Smart Metering System, it would require the development of a new SMETS Device. This option was dismissed due to its similarities with the initial proposed solution of a *Smart EV charger.*

Use of Type 2 Devices

Working Group discussions were around the use of Consumer Access Devices (CADs). The Working Group preferred to be general and refer to them as Type 2 Devices. This method was considered simpler to implement and would allow a one-way signal to be delivered to the domestic EV charger. However, this would not be suitable in an overloading event as it cannot receive an external signal and will only alter load based on predefined parameters. Therefore, this was dismissed as a plausible solution.

Requirements and specifications

Once the Working Group had established that the *HCALCS connected EV charger* solution was to be progressed, discussions were regarding the requirements and specifications to achieve this:

- Electricity Distributors will monitor load demand on low voltage networks (Feeders)
- Electricity Distributors will have the ability to alter charging amperage of domestic Electric Vehicle chargers
- Electricity Distributors will be able to join necessary devices (rather than requesting an Import Supplier to do so)
- The customer can decline alteration of electricity supply to their domestic Electric Vehicle chargers
- Electricity Distributors will report instances when they alter domestic Electric Vehicle charging to Ofgem
- Governance that is out of scope for this modification and out of scope for the SEC

These are fully defined in the business requirements in Annex A.

Since the DCC Preliminary Assessment, the Working Group has discussed including an additional requirement:

- The DSP will provide an alert to the Electricity Distributor if a Supplier sends a Service Request to remove a HCALCS from a Smart Metering System

If a Device is thought to be disrupting a Smart Metering System, the Relevant Supplier can unjoin the Device. The Working Group discussed that if such a scenario occurred, then the Electricity Distributor should be notified. Once notified the Electricity Distributor can contact the Supplier to discuss the issue and are also aware that the functionality of the HCALCS may not be available for that specific property. This additional requirement will be considered in the Refinement Consultation.

Furthermore, SECMP0019 'ALCS Description Labels'[6], implemented 1 November 2018, defined a list of label for ALCS/HCALCS. SECMP0019 did not make labelling in accordance with this list mandatory. The Working Group agree that as part of SECMP0046, the it must be mandated to label ALCS/HCALCS in accordance with this list, so as to allow the Electricity Distributor to target an EV charger connected to the HCALCS.

[6] The SECMP0019 Modification Report covers all discussions considerations in creating this list and populating labels

Working Group assumptions

BEIS

The Working Group are aware that the Department for Business, Energy and Industrial Strategy (BEIS) currently are working on developments in the EV space. Included in this is the development of a new SMETS2 device, the Proportional Load Control[7]. The Working Group are expecting that the extension of HCALCS functionality to the Electricity Distributors will be reflected in the Proportional Load Control Switch.

DCC

The Working Group would like the to ensure that the DCC Service Providers are aware of the developments currently occurring in the EV space. They would like the DCC Service Providers to take this into consideration when implementing the solution to enable a level of futureproofing.

[7] Consultation on Proportional Load Control and associated SMETS drafting, BEIS, August 2019

8. Conclusions

Benefits and drawbacks

The Proposer and the Working Group have identified the following benefits and drawbacks in implementing this modification:

Benefits

- Reduced risk of power outages from feeders failing in circumstances when electricity demand is high, and all other mechanisms have failed.
- Prolongs the need to replace existing feeders and the high financial cost associated with this.

Drawbacks

- The HCALCS is a binary switch. How the domestic EV charger interacts with this binary switch is out of scope of this modification. The EV charger may be able to interpret the binary signal as a value or percentage to change the charging load. Without the EV charger interpreting the HCALCS signal it would react as an on/off function. However, multiple HCALCS could be set in parallel and controlled independently to reduce the load.
- Consumers will temporarily have load to their charging EV reduced.

Proposer's rationale against the General SEC Objectives

Objective (e)[8]

The Proposer believes that SECMP0046 will better facilitate SEC Objective (e). Giving Electricity Distributor control of EV chargers when low voltage cables are under stress is a positive innovation for the use of smart technology for Electricity Networks, enabling more efficient operation of existing infrastructure. Additionally, it will best facilitate the sustainable and secure Supply of Energy due to reduced risk of power outages, and decreased or deferred costs to reinforce the electricity networks.

Working Group members' views

The views of the Working Group are in support of this modification being progressed. After discussions of potential solutions, they agreed using HCLACS would be the most practical method. However, the Working Group would like the additional requirement of a DSP alert when a Supplier attempts to unjoin the HCALCS.

[8] Facilitate innovation in the design and operation of energy networks to contribute to the delivery of a secure and sustainable supply of energy

Appendix 1: Glossary

This table lists all the acronyms used in this document and the full term they are an abbreviation for.

Glossary	
Acronym	**Full term**
ALCS	Auxiliary Load Control Switch
BEIS	Department for Business, Energy and Industrial Strategy
DCC	Data Communication Company
DCUSA	Distribution Connection and Use of System Agreement
DSP	Data Service Provider
DUIS	DCC User Interface Specification
EV	Electric Vehicle
GBCS	Great Britain Companion Specification
HAN	Home Area Network
HCALCS	Han Connected Auxiliary Load Control Switch
SEC	Smart Energy Code
SECAS	Smart Energy Code Administrator and Secretariat
SRV	Service Reference Variant
SSEN	Scottish and Southern Electricity Networks
V2G	Vehicle to Grid

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